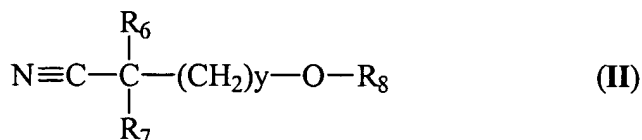
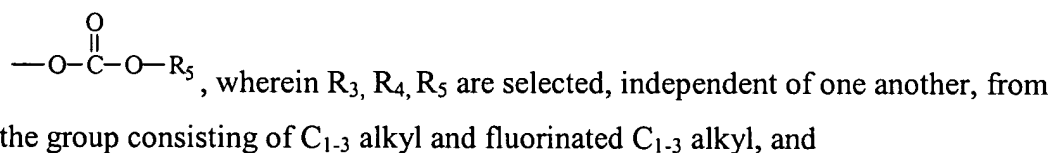
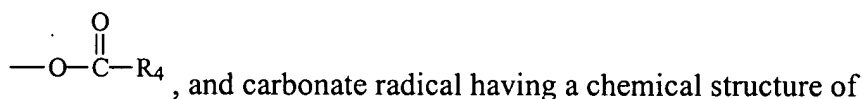


## WHAT IS CLAIMED IS:

1. A non-aqueous electrolyte, comprising: (1) at least one electrolyte salt selected from the group consisting of  $\text{LiPF}_6$ ,  $\text{LiBF}_4$ ,  $\text{LiAsF}_6$ ,  $\text{LiCl}_4$ ,  $\text{LiN}(\text{SO}_2\text{CF}_3)_2$ , and a lithium perfluoro-sulfonate, (2) a first non-aqueous solvent selected from the group consisting of at least one cyclic carbonate, linear carbonate, ester, and ether, and (3) a second non-aqueous solvent being at least one of the nitrile compounds represented by the following general formula (I) and (II):



wherein  $\text{R}_1$ ,  $\text{R}_2$  are selected, independent of one another, from the group consisting of hydrogen,  $\text{C}_{1-3}$  alkyl, fluorinated  $\text{C}_{1-3}$  alkyl groups; wherein X is selected from ether radical having a chemical structure of  $-\text{O}-\text{R}_3$ , ester radical having a chemical structure of

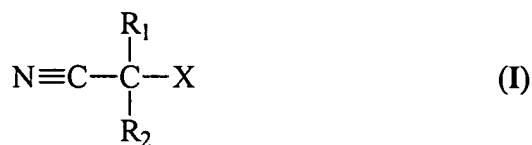


wherein  $\text{R}_6$ ,  $\text{R}_7$  are selected, independent of one another, from the group consisting of hydrogen,  $\text{C}_{1-3}$  alkyl, fluorinated  $\text{C}_{1-3}$  alkyl groups; Y stands an integer of 1 and 2;  $\text{R}_8$  is selected from the group consisting of  $\text{C}_{1-3}$  alkyl and fluorinated  $\text{C}_{1-3}$  alkyl, wherein the second solvent is present in an amount of from about 20 to about 95% by weight as of the total of non-aqueous solvents.

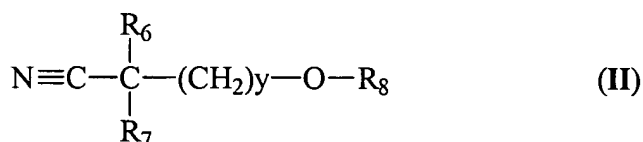
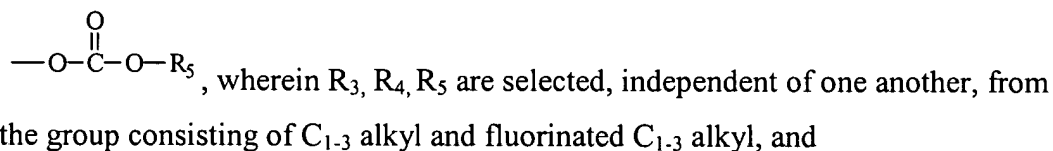
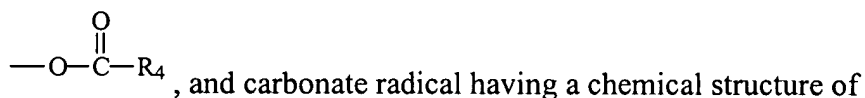
2. The non-aqueous electrolyte of claim 1, wherein said electrolyte salt is a mixture of  $\text{LiPF}_6$  and  $\text{LiBF}_4$  in a molar ratio from about 90:10 to about 50:50.
3. The non-aqueous electrolyte of claim 1, wherein the first solvent is present in an amount of from about 5 to about 80 by weight as of the total of non-aqueous solvents.
4. The non-aqueous electrolyte of claim 1, wherein the second non-aqueous solvent is selected from the group consisting of 3-methoxypropionitrile, 3-ethoxypropionitrile, methoxyacetonitrile, ethoxyacetonitrile, 2-acetoxyisobutyronitrile, 2-cyanoisopropyl methyl carbonate, 2-acetoxyacetonitrile, 2-acetoxyisopropionitrile, cyanomethyl methyl carbonate, and 1-cyanoethyl methyl carbonate.
5. The non-aqueous electrolyte of claim 1, wherein the second non-aqueous solvent is present in an amount of from about 25 to about 80% by weight as of the total of non-aqueous solvents.
6. The non-aqueous electrolyte of claim 1, wherein the second non-aqueous solvent is present in an amount of from about 30 to about 50% by weight as of the total of non-aqueous solvents.
7. A non-aqueous electrolyte comprising: (1) electrolyte salt containing  $\text{LiPF}_6$  and  $\text{LiBF}_4$  in a molar ratio from about 90:10 to about 50:50, (2) a first non-aqueous solvent selected from the group consisting of ethylene carbonate, propylene carbonate, diethyl carbonate, dimethyl carbonate, and ethyl methyl carbonate, and (3) a second non-aqueous solvent selected from the group consisting of 3-methoxypropionitrile, 3-ethoxypropionitrile, methoxy acetonitrile, ethoxyacetonitrile, 2-acetoxyisobutyronitrile, 2-cyanoisopropyl methyl carbonate, 2-acetoxyacetonitrile, 2-acetoxyisopropionitrile, cyanomethyl methyl carbonate, and 1-cyanoethyl methyl carbonate.

8. The non-aqueous electrolyte of claim 1, wherein the ionic conductivity of said electrolyte is greater than  $9 \times 10^{-3}$  S/cm at about 25°C.
9. The non-aqueous electrolyte of claim 1, wherein the ionic conductivity of said electrolyte is greater than  $1 \times 10^{-3}$  S/cm at about -30°C.
10. The non-aqueous electrolyte of claim 1, wherein the ionic conductivity of said electrolyte is greater than  $3 \times 10^{-4}$  S/cm at about -50°C.
11. The non-aqueous electrolyte of claim 1, wherein the weight loss of said electrolyte is less than 3% after heated at 90°C for 2 hours.
12. The non-aqueous electrolyte of claim 1, wherein the weight loss of said electrolyte is less than 5% after heated at 90°C for 4 hours.
13. The non-aqueous electrolyte of claim 1, wherein the freezing point of said electrolyte is less than -60°C .
14. The non-aqueous electrolyte of claim 1, wherein the boiling point of said nitrile is higher than 120°C.
15. The non-aqueous electrolyte of claim 1, wherein the flash point of said nitrile is higher than 60°C.
16. The non-aqueous electrolyte of claim 1, wherein the molecular weight of said nitrile is smaller than 90.
17. A lithium-ion battery comprising (1) at least one positive electrode made of lithiated metal oxide selected from the group consisting of  $\text{LiCoO}_2$ ,  $\text{LiNiO}_2$ ,  $\text{LiMn}_2\text{O}_4$ ,  $\text{LiFePO}_4$ , and  $\text{LiCo}_x\text{Ni}_{1-x}\text{O}_2$  wherein the x is from 0.1 to 0.9, (2) at least one negative electrode made of carbonaceous material selected from the group

consisting of coke and graphite, (3) a separator membrane, and (4) a non-aqueous electrolyte which comprises (i) an electrolyte salt, (ii) a first non-aqueous solvent, and (iii) a second non-aqueous solvent being at least one of the nitrile compounds represented by the following general formula (I) and (II):



wherein  $\text{R}_1$ ,  $\text{R}_2$  are selected, independent of one another, from the group consisting of hydrogen,  $\text{C}_{1-3}$  alkyl, fluorinated  $\text{C}_{1-3}$  alkyl groups; wherein  $\text{X}$  is selected from ether radical having a chemical structure of  $-\text{O}-\text{R}_3$ , ester radical having a chemical structure of



wherein  $\text{R}_6$ ,  $\text{R}_7$  are selected, independent of one another, from the group consisting of hydrogen,  $\text{C}_{1-3}$  alkyl, fluorinated  $\text{C}_{1-3}$  alkyl groups;  $Y$  stands an integer of 1 and 2;  $\text{R}_8$  is selected from the group consisting of  $\text{C}_{1-3}$  alkyl and fluorinated  $\text{C}_{1-3}$  alkyl,

wherein the second solvent is present in an amount of from about 20 to about 95% by weight as of the total of non-aqueous solvents.

18. The lithium-ion battery of claim 17, wherein said electrolyte salt comprises a cation and an anion, said cation being selected from the group consisting of lithium ion, sodium ion and potassium ion, and said anion being selected from the

group consisting of anions of halides of elements of the groups IIIa and Va of the periodic table, halogen anions, and perchloric acid anions.

19. The lithium-ion battery of claim 17, wherein said electrolyte salt is selected from the group consisting of  $\text{LiPF}_6$ ,  $\text{LiBF}_4$ ,  $\text{LiAsF}_6$ ,  $\text{LiCl}_4$ ,  $\text{LiN}(\text{SO}_2\text{CF}_3)_2$ , lithium perfluoro-sulfonates, and combination thereof.
20. The lithium-ion battery of claim 17, wherein said first non-aqueous solvent is selected from the group consisting of cyclic carbonate, linear carbonate, ester, ether and combination thereof.
21. A lithium-ion battery comprising (1) at least one lithium-ion positive electrode (2) at least one lithium-ion negative electrode (3) a separator membrane, and (4) a non-aqueous electrolyte comprising: (i) electrolyte salt containing  $\text{LiPF}_6$  and  $\text{LiBF}_4$  in a molar ratio from about 90:10 to about 50:50, (ii) a first non-aqueous solvent selected from the group consisting of ethylene carbonate, propylene carbonate, diethyl carbonate, dimethyl carbonate, and ethyl methyl carbonate, and (iii) a second non-aqueous solvent selected from the group consisting of 3-methoxypropionitrile, 3-ethoxypropionitrile, methoxy acetonitrile, ethoxyacetonitrile, 2-acetoxyisobutyronitrile, 2-cyanoisopropyl methyl carbonate, 2-acetoxyacetonitrile, 2-acetoxyisopropionitrile, cyanomethyl methyl carbonate, and 1-cyanoethyl methyl carbonate, wherein the first solvent is present in an amount of from about 5 to about 80% by weight as of the total of non-aqueous solvents, the second solvent is present in an amount of from about 20 to about 95% by weight as of the total of non-aqueous solvents.
22. A method of making a lithium-ion battery of claim 17, comprising the steps of (a) assembling battery by sandwiching at least a separator membrane between at least a positive electrode and at least a negative electrode, (b) packaging the assembled battery cell into a battery case, (c) preparing non-aqueous electrolyte of claim 1, and (d) adding the non-aqueous electrolyte into the battery case.